Reactor Safety

Significance Determination Process

Significance Determination Process Purpose.

- The SDP is designed to assess only those inspection findings within the cornerstones of initiating events, mitigation systems, and barrier integrity under the reactor safety strategic performance area.

SDP Objectives

1 To characterize the risk significance of an inspection finding consistent with the regulatory response thresholds used for performance indicators (P.I.s) in the NRC licensee performance assessment process and for entry into enforcement.

2 To provide a risk-informed framework for discussing and communicating the potential significance of inspection findings.

SDP Description

- The inspection finding assessment process (SDP) is a graduated approach that uses a three-phase process to differentiate inspection findings on the basis of their actual or potential risk significance. Findings that pass through a screening phase will proceed to be evaluated by the next phase.

SDP Phase 1

- Phase 1 - **Definition and Initial Screening of Findings:** Precise characterization of the finding and an initial screening out of low-significant issues.

Safety Functions

- Reactivity Control
- Maintenance of Vital Auxiliaries
- RCS Inventory Control
- Heat Removal
- RCS Integrity
- Containment Integrity
- Containment Pressure/Temperature Control
- Containment Combustible Gas Control

WORKSHEET FOR REACTOR AND PLANT SYSTEM DEGRADED COMMONS

Preference/Title (LER #, Inspection Report #. etc):

Factual Description of Identified Condition (statement of facts known about the issue, without hypothetical failures included):

System(s) and Train(s) with degraded condition:

Licensing Basis Function (if applicable):

Maintenance Rule category (check one): _____risk-significant _____ non-risk significant

Time degraded condition existed or assumed to exist:

Functions and Cornerstones degraded as a result of this condition (check ‣)

INITIATING EVENT CORNERSTONE

_____Transient initiator contributor (i.e., reactor/turbine trip loss offsite power)

_____Primary Or Secondary system LOCA initiator contributor (e.g., RCS or main steam/feedwater pipe degradations and leaks)

MITIGATION CORNERSTONE

_____Core Decay Heat Removal

_____Initial injection heat removal paths

_____ Primary (e.g., Safety Inj)

_____ Low Pressure

BARRIER CORNERSTONE

_____ RCS LOCA mitigation boundary degraded (e.g., PORV block valve, PTS issue)

_____ Containment integrity

_____ Breach or bypass

PHASE 1 SCREENING PROCESS
Check the appropriate boxes **U**

Cornerstone(s) assumed degraded:

9 Initiating Event **9** Mitigation Systems **9** RCS Barrier **9** Fuel Barrier **9** Containment Barrier

If more than one Cornerstone is degraded, then go to Phase 2. If NO Cornerstone is degraded, then the condition screens OUT as "Green" and is not assessed further by this process.

If only one Cornerstone is degraded, continue in the appropriate column below.

Initiating Event	Mitigation Systems	RCS Barrier	Fuel Barrier	Containment Barrier
1. Does the issue contribute to the likelihood of a Primary or Secondary system LOCA initiator? **9 If YES ý Go to Phase 2** If NO, continue 2. Does the issue contribute to both the likelihood of a reactor trip AND the likelihood that mitigation equipment will not be available? **9 If YES ý Go to Phase 2** **9** If NO, screen OUT	1. Is the issue a design or qualification deficiency that does NOT affect operability per GL 91-18 (rev 1)? **9 If YES ý Screen OUT** If NO, continue 2. Does the issue represent an actual Loss of Safety Function of a System? **9 If YES ý Go to Phase 2** If NO, continue 3. Does the issue represent an actual Loss of Safety Function of a Single Train, for > TS AOT? **9 If YES ý Go To Phase 2** If NO, continue 4. Does the issue represent an actual Loss of Safety Function of a Single Train of non-TS equipment designated as risk-significant under 10CFR50.65, for > 24 hrs? **9 If YES ý Go To Phase 2** **9** If NO, screen OUT	**9** 1. **Go to Phase 2**	**9** 1.Screen OUT	1. TBD

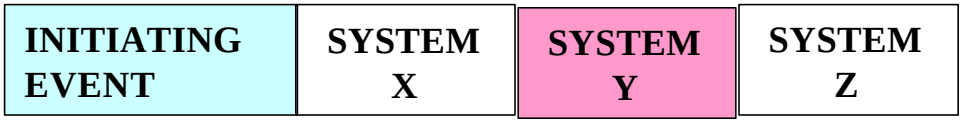
Result of the Phase 1 screening process: _____ screen OUT as "Green" _____ go to Phase 2

Important Assumptions (as applicable):

SDP Phase 2

- Phase 2 - **Risk Significance Approximation and Basis:** Initial approximation of the risk significance of the finding and development of the basis for this determination for those findings that pass through Phase 1 screening.

SDP Basics



Risk Estimation Worksheets

Example Initiating Event Scenarios To Be Considered

Table 1

Estimated Likelihood for Initiating Event

Table 2

Risk Significance Estimation Matrix

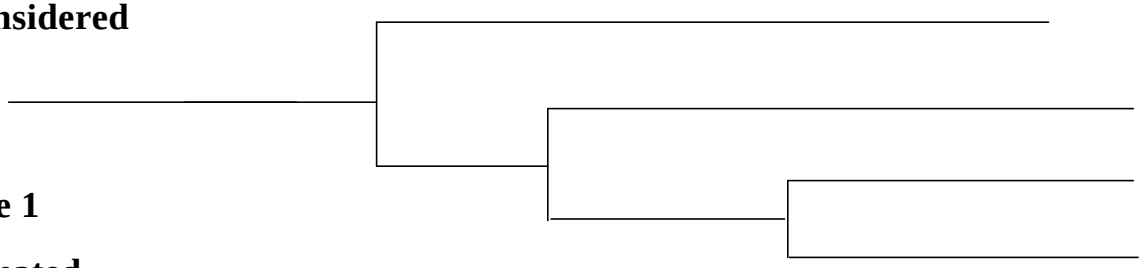


Table 3 - Remaining Capability Values

Affected System	Major Components	Support Systems	Initiating Event Scenarios
AFWS	AFWTDP/Valves Control I&C	125 V-DC 115 V-AC Control air	Transient, LOOP, MSLB (Outside Containment), SGTR, SLOCA from PORV/SRV/RCP, MFLB, MSLB (Inside Containment), SLOCA from pipe breaks, ATWS
	AFWMDP Control I&C	4 KV bus A&B 125 V-DC, 28 V-DC, 115 V-AC, and HVAC	
HHSI	Pumps Valves I&C including DC for 4.16 KV breakers	4.16 KV, and 125 V-DC, 28 V-DC, SW, CCW, and HVAC	Transient, LOOP, MSLB (Outside Containment), SGTR, SLOCA from PORV/SRV/RCP, MFLB, MSLB (Inside Containment), SLOCA from pipe breaks, ATWS
HHSI (Recirculation)	Pumps Valves	4.16 KV, and 125 V-DC, 28 V-DC, SW, CCW, and HVAC	Transient, LOOP, MSLB (Outside Containment), SGTR, SLOCA from PORV/SRV/RCP, MFLB, MSLB (Inside Containment), SLOCA from pipe breaks, ATWS
LPSI/RHR/ (Recirculation)	Pumps Valves	4.16 KV, and 125 V-DC, 28 V-DC, SW, CCW, and HVAC	Transient, LOOP, MSLB (Outside Containment), SGTR, SLOCA from PORV/SRV/RCP, MFLB, MSLB (Inside Containment), SLOCA from pipe breaks, M/L LOCA
CS (Recirculation)	Pumps Heat Exchanger Valves	4.16 KV, 125 V-DC, CCW, 28 V-DC, HVAC, SW	Transient, LOOP, MSLB (Outside Containment), SGTR, SLOCA from PORV/SRV/RCP, MFLB, MSLB (Inside Containment), SLOCA from pipe breaks, M/L LOCA
EDG	Cooling (unit 1 only) HVAC Start system Fuel system	Service Water, 125 V-DC, 28 V-DC, and HVAC	LOOP

Row	Approx. Freq.	Example Event Type	Estimated Likelihood Rating		
I	>1 per 1 - 10 yr	Reactor Trip Loss of Power Conv. Sys. (loss of condensor, closure of MSIVs, loss of feedwater)	**A**	**B**	**C**
II	1 per 10 - 10^2 yr	Loss of Offsite Power Small LOCA (BWR) (Stuck open SRV only) MSLB (outside cntmt)	**B**	**C**	**D**
III	1 per 10^2 - 10^3 yr	SGTR Stuck open PORV (PWR) Small LOCA (PWR) (RCP seal failures and stuck open SVs only) MFLB MSLB (inside PWR cntmt)	**C**	**D**	**E**
IV	1 per 10^3 - 10^4 yr	Small LOCA (pipe breaks) ATWS-PWR (elect only)	**D**	**E**	**F**
V	1 per 10^4 - 10^5 yr	Med LOCA Large LOCA ~~(BWR)*~~ ATWS-BWR	**E**	**F**	**G**
VI	<1 per 10^5 yr	~~Large LOCA (PWR)*~~ ATWS-PWR (mech only) ISLOCA Vessel Rupture	**F**	**G**	**H**
			> 30 days	30-3days	<3 days
			Exposure Time for Degraded Condition		

*Pending change

Table 1 - Estimated Likelihood for Initiating Event Occurrence During Degraded Period

PHASE 2 RISK ESTIMATION WORKSHEET Transients

Estimated Frequency (Table 1 Row) _____ Exposure Time _____ Table 1 Result (circle): A B C D E F G H

Safety Functions Needed:	*Full* Creditable Mitigation Capability for each Safety Function:
Power Conversion System (PCS)	1 / 2 Feedwater trains and 1/3 condensate pump (1 multi-train system)
Secondary Heat Removal (AFW)	1 / 2 MDAFW trains (1 multi-train system) or 1 TDAFW train (1 ASD train)
Primary Heat Removal, Feed/Bleed (FB)	2 / 2 PORVs open for Feed/Bleed (operator action)
High Pressure Injection for FB (EIHP)	1 / 4 Charging or SI trains (multi-train system)
High Pressure Recirculation (HPR)	1 / 4 Charging or SI trains taking suction from 1 / 2 LPSI trains with successful switchover to sump (operator action)

Circle Affected Functions	**Recovery of Failed Train**	***Remaining* Mitigation Capability Rating for Each Affected Sequence**	***Sequence Color***
1 TRANS - AFW - PCS - FB (6)			
2 TRANS - AFW - PCS -EIHP (5)			
3 TRANS - AFW - PCS - HPR (4)			

Identify any operator recovery actions that are credited to directly restore the degraded equipment or initiating event:

If operator actions are required to credit placing mitigation equipment in service or for recovery actions, such credit should be given only if the following criteria are met: 1) sufficient time is available to implement these actions, 2) environmental conditions allow access where needed, 3) procedures exist, 4) training is conducted on the existing procedures under conditions similar to the scenario assumed, and 5) any equipment needed to complete these actions is available and ready for use.

Type of Remaining Capability	Remaining Capability Rating
Operator Action Under High Stress Definition: Operator action assumed to have about a 1E-1 probability of failing when credited as “remaining mitigation capability”.	1
Recovery of Failed Train Definition: Operator action to recover failed equipment that is capable of being recovered after an initiating event occurs that requires the equipment (e.g., equipment was unavailable due to a switch misalignment). Action may take place either in the control room or outside the control room and is assumed to have about a 1E-1 probability of failing when credited as “remaining mitigation capability”.	1
1 Automatic Steam-Driven (ASD) Train Definition: A collection of associated equipment that includes a single turbine-driven component to provide 100% of a specified safety function. The probability of such a train being unavailable due to failure, test, or maintenance is assumed to be about 1E-1 when credited as “remaining mitigation capability”.	1
Operator Action Definition: Operator action that can occur with sufficient time to have about a 1E-2 probability of failing when credited as “remaining mitigation capability”.	2
1 Train (diverse as compared to other trains) Definition: A collection of associated equipment (e.g., pumps, valves, breakers, etc.) that together can provide 100% of a specified safety function and for which the probability of being unavailable due to failure, test, or maintenance is assumed to be about 1E-2 when credited as “remaining mitigation capability”. Two or more trains are diverse if they are not considered to be susceptible to common cause failure modes.	2
1 Multi-Train System Definition: A system comprised of two or more trains (as defined above) that are considered susceptible to common cause failure modes. Such a system is assumed to have about a 1E-3 probability of being unavailable, regardless of how many trains comprise the system, when credited as “remaining mitigation capability”.	3
2 (diverse) Trains [adding example] (2 diverse trains are assumed to have a combined 1E-4 probability of being unavailable)	4 (= 2 + 2)
1 Train + Recovery of Failed Train [adding example] (1 train plus recovery of failed train is assumed to have a combined 1E-3 probability of being unavailable or failed)	3 (=2 + 1)

Table 3 - Remaining Capability Rating Values

Rev. 11/5/99

Initiating Event Likelihood	Remaining Mitigation Capability Rating (with Examples)						
	6	**5**	**4**	**3**	**2**	**1**	**0**
	3 diverse trains OR 2 multi-train systems OR 1 train + 1 multi-train system + recovery of failed train	1 train + 1 multi-train system OR 2 diverse trains + recovery of failed train	2 diverse trains OR 1 multi-train system + recovery of failed train	1 train + recovery of failed train OR 1 multi-train system OR Operator action + recovery of failed train	1 train OR Operator action OR Operator action under high stress + recovery of failed train	Recovery of failed train OR Operator action under high stress	none
A	Green	White	Yellow	Red	Red	Red	Red
B	Green	Green	White	Yellow	Red	Red	Red
C	Green	Green	Green	White	Yellow	Red	Red
D	Green	Green	Green	Green	White	Yellow	Red
E	Green	Green	Green	Green	Green	White	Yellow
F	Green	Green	Green	Green	Green	Green	White
G	Green	Green	Green	Green	Green	Green	Green
H	Green	Green	Green	Green	Green	Green	Green

Table 2 - Risk Significance Estimation Matrix (rev 6/10/99)

SDP Rules

- Compliance with Technical Specifications is required regardless of the SDP risk result.

- When determining the risk associated solely with the licensee performance problem(s), it is not necessary to include equipment that is out of service for routine maintenance.

SDP Rules

- If the sum of Operator Recovery and Remaining Mitigating Capability for a sequence is greater than six (6), the result is GREEN. The counting rule cannot be used with this result.

- If a system requires operator action to place the system in service, use a value of 2 for the remaining mitigation capability for this system.

SDP Rules

- Counting Rule - Note the number of counts in each green cell that is adjacent to a white cell (i.e., A6, B5, C4, D3, E2, F1, and G0). If three counts occur in any single cell or if three counts occur in an combination of these cells, go to Phase 3.

SDP Phase 3

- Phase 3 - **Risk Significance Finalization and Justification:** As-needed refinement of the risk significance of Phase 2 findings by an NRC risk analyst.